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File Report

GALL MIDGES OF THE GENUS CONTARINIA (DIPTERA: CECIDOMYIIDAE) ATTACKING TREES IN NORTH AMERICA, WITH EMPHASIS ON THE SPECIES PRODUCING GALLS ON THE NEEDLES OF DOUGLAS-FIR

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INTRODUCTION

In North America there are at least 12 species of Contarinia attacking trees. Each of these is generally host specific, usually attacking a single tree species; however, collectively their hosts include both gymnosperms and angiosperms. Injury to the host tree is usually done to a particular plant part. The following list indicates the host and plant part attacked for the 12 species attacking trees:

C. canadensis: midribs of leaves of Fraxinus americana
C. coloradensis: needles (and buds ?) of Pinus ponderosa and Pinus edulis
C. constricta: needles of Pseudotsuga menziesii
C. cuniculator: needles of Pseudotsuga menziesii
C. juniperina: needle bases, sometimes twigs, of Juniperus
C. negundifolia: leaves of Acer negundo
C. oregonensis: cone scales of Pseudotsuga menziesii
C. pseudotsugae: needles of Pseudotsuga menziesii
C. pyrivora: fruit of Pyrus
C. tiliarium:* twigs of Tilia
C. virginianae: fruit of Prunus virginiana
C. washingtonensis: cone scales of Pseudotsuga menziesii

*doubtfully a species of Contarinia

Some of the American species of CONTARINIA, their hosts, and the plant part galled.

C. agrimoniae: florets of Agrimonia (ROSACEAE)
C. canadensis: midribs of leaves of Fraxinus americana (OLEACEAE) ash midrib gall
C. clematidis: buds of Clematis (RANUNCULACEAE) Clematis bud gall
C. coloradensis: buds of Pinus ponderosa, needles and needle bundles of Pinus edulis (PINICEAE) Colorado pine bud gall
C. constricta: needles of Pseudotsuga menziesii (PINACEAE)
C. cuniculator: needles of Pseudotsuga menziesii (PINACEAE)
C. gossypii: flower buds of Gossypium (MALVACEAE) cotton bud midge
C. johnsoni: flower buds of Vitis (VITACEAE) grape blossom midge

C. juniperina: needle bases, sometimes twigs, of Juniperus juniper midge
C. lycopersici: flowers of Lycopersicum (SOLANACEAE) tomato flower gall
C. negundifolia: leaves of Acer negundo (ACERACEAE) boxelder leaf gall
C. oregonensis: cone scales of Pseudotsuga menziesii (PINACEAE) Douglas-fir cone midge
C. perfoliata: florets of Eupatorium (COMPOSITAE) Boneset blossom midge
C. pseudotsugae: needles of Pseudotsuga menziesii (PINACEAE)
C. pyrivora: fruit of Pyrus (ROSACEAE) pear midge
C. rumicis: seeds of Rumex (POLYGONACEAE) Dock seed midge
C. setigera: fruit of Cucumeris (CUCURBITACEAE) Muskmelon tip midge
C. sorghicola: seeds of Sorghum (GRAMINEAE) Sorghum midge
C. spiraeina: buds of Spiraea (ROSACEAE) Spiraea cabbage gall
C. tiliarum:* twigs of Tilia (RILIACEAE) Linden twig gall
C. vaccinnii: fruit of Vaccinium (ERICACEAE)
C. virginianiae: fruit of Prunus virginiana (ROSACEAE) Chokecherry midge
C. Washingtonensis: cone scales of Pseudotsuga menziesii (PINACEAE)

*doubtfully a species of Contarinia

ECONOMIC IMPORTANCE

Injury caused by Contarinia gall midges to broad-leaved trees is generally not important, except in the case of C. pyrivora which causes premature fall and distortion of pears in northeastern North America.

The importance of the Contarinia species attacking conifers has, for the most part, been recognized only recently. One indication of this is that of the 7 species attacking conifers in North America 5 have been described since 1956. Included among the more recently described species are the 2 most important in forestry: C. oregonensis and C. pseudotsugae.

C. oregonensis galls on the cone scales of Douglas-fir prevent fall of the seeds from the cones. Damage of this kind has reduced seed crops by at least 50 percent in some years in parts of the Pacific Coast Douglas-fir region. C. washingtonensis is another species feeding in the cone scales of Douglas-fir in the Pacific Northwest, but the damage it does to seed crops is normally of less consequence than that done by C. oregonensis.

C. pseudotsugae is an insect of considerable concern to Christmas tree growers in parts of the Pacific Coast states. Feeding of the larvae in the needles of Douglas-fir cause distortion or early fall of the needles. Heavy infestation may result in death of buds and twigs, and, thus, tree deformation. Two other species producing galls on the needles of Douglas-fir are C. constricta and C. cuniculator, but severe infestations by these species have been few and very local.

LIFE HISTORY

There is generally one generation each year for Contarinia gall midges.

Emergence of adults and oviposition usually occurs in mid-spring. Oviposition of C. pseudotsugae and C. constricta usually coincides is usually on the lower surface of needles soon after bursting of the buds or under the scales of swollen buds. Females of these species seldom deposit their eggs on fully extended needles. The life history of C. cuniculator lags a week or two behind that of C. pseudotsugae and C. constricta; thus eggs of this species are often laid on somewhat extended needles, usually on the upper surface. Of the cone-inhabiting species, C. oregonensis lays eggs when the conelets are open for pollination but C. washingtonensis lays eggs after the conelets have closed.

Up to 40 larvae of C. pseudotsugae may inhabit a single needle, but usually only one larva of C. constricta and C. coniculator inhabits a single needle. The galls of C. pseudotsugae and C. constricta are apparent on both sides of a needle, with those of C. pseudotsugae occurring on the apical third of a needle and those C. constricta occurring on the middle third. The galls of C. coniculator are apparent only on the upper needle surface and occur on the basal third of the needle. Of the cone-inhabiting species, C. oregonensis larvae usually feed in the area immediately beneath and surrounding the seed, causing a hard gall to form that fuses the seed to the cone scale. C. washingtonensis larvae mine in the cone scale but not so much in the immediate area of the seed, and they do not cause formation of a gall. The first instar of the needle midges usually lasts about 12 weeks, whereas that of cone midges usually lasts about 6 weeks. (The entire larval development of P. pyrivora is usually completed in 6 weeks.) The second instar of both needle and cone midges lasts about 6 weeks. The initial part of the third instar is spent in the infested plant part, but in the early and mid-fall the third instar larvae have the needles and cones and fall to the soil. Needle midges leave the needles about the time of the first frosts. Of the cone midges, C. oregonensis does not have the cones until after they are wetted by rain; however, C. washingtonensis leaves the cones at an earlier date, usually when the cones are somewhat green. Upon reaching the soil the third instar form cocoons and overwinter. Pupation occurs in April, and emergence usually sometime in May.

CONTROL OF THE DOUGLAS-FIR NEEDLE MIDGES

Little is known about the natural control of C. pseudotsugae, C. constricta, and C. curiculator. Several larval parasites observed but their importance has not been assessed. It is interesting to note, however, that C. pseudotsugae is apparently able to resist parasitism to some extent by encapsulating parasite eggs. Ants and spiders appear to be the most important predators. Probably the most important factor in the natural control of the needle-galling species is phenological asynchronism between the insects and their host tree. The more asynchronous is insect emergence and vegetative bud-bursting in the spring the greater is the mortality to eggs and young larvae.

Satisfactory chemical control of the Douglas-fir needle midges has not been developed. Perhaps some of the chemicals effective against cone midges would be effective. These would include Guthion, Sevin, and phorate, and the systemics demeton and phosphamidon. The first three of these would probably be best applied just before the peak of adult emergence in the spring. The systemics probably would be best applied soon after egg hatch. Application might be made as foliar sprays by helicopter or back-pack rig, depending on the size of the area to be sprayed and the chemical to be used.

Several cultural practices are of aid in reducing or working around needle midge damage:

1. Selection of planting stock with vegetative bud-bursting most asynchronous with insect emergence.

2. Natural Douglas-fir stands intended for Douglas-fir management should be selected outside the known areas of severe infestation.

3. Where severe needle midge infestations are recurrent, other species of trees should be selected for Christmas tree plantations.